CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Zoie S. Andre

Project Number
J1102

Project Title
Living Shorelines to Mitigate Sea Level Rise

Abstract

Objectives/Goals
Living shorelines are a method to protect coastal shorelines while maintaining self-sustaining biological habitat. This project will help to determine which natural material structures can create conditions for the most effective living shorelines. I tested whether willow branch bundles, oyster shell bundles or coir log structures would accumulate the most sediment and organic material.

Methods/Materials
Three of each structure type was installed in the intertidal zone of Humboldt Bay, adjacent to the Arcata wastewater treatment plant. The nine one square meter structures were installed during the winter storm period and allowed to trap material for twenty one days. The volume of organic material and sediment was collected and measured for each structure.

Results
After the measurement of material within the living shoreline structures, the willow bundle structures resulted in the greatest quantity of trapped material. The coir log structures accumulated the least amount of material.

Conclusions/Discussion
The data obtained did not support the hypothesis that the coir log structures would trap the most material. Instead, the willow branch structures accumulated material most effectively. I can conclude that living shorelines are achievable in Humboldt Bay when using the correct natural materials. Natural material type structures that effectively trap sediment and organic material will promote salt marsh growth. Living shorelines will be an essential type of shoreline protection to lessen sea level rise damage and buffer shorelines from coastal erosion while protecting, restoring and enhancing habitats.

Summary Statement
This study compared the effectiveness of natural material structures to develop living shorelines on the coast of Humboldt Bay.

Help Received
Humboldt Bay Oyster provided shells. Used the City of Arcata wastewater lab equipment for turbidity sample with assistance of Dr. Robert Gearheart and Rachel Hernandez. My father purchased supplies and drove me to the project site.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Nadia Ansari

Project Number
J1103

Project Title
Passive Xylem Filter for Bacterial Elimination from Wastewater

Abstract

Objectives/Goals
The purpose of my study is to examine passive flow, without applying vacuum or suction, through xylem (microscopic tubes inside the branch) filters using both Pine (gymnosperm) and Eucalyptus (angiosperm) tree branches to build a low-cost filter to make contaminated water safe to drink

Methods/Materials
Materials: Pine and Eucalyptus Tree branches, PVC Tubing, Metal Pipes, Epoxy, Plumbers Tape, Probiotic Capsules (Lactobacillus, Bifido, Streptococcus) to make contaminated water, Shelving unit, Clamps, Bacteria Enrichment Tubes, Bacteria Detection Tubes, Luminometer, Incubator, Digital Scale
Methods: Different filters were constructed using a wood chip at the end of a PVC tube or a metal pipe to measure water flow and bacterial elimination from contaminated water. Contaminated water was created using probiotic capsules with lactobacillus and bifido bacteria species. Pre-filtration bacteria sample from the top of each filter was taken as well as sample post-filtration. The samples were placed in the enrichment device into the incubator set at 30 degrees C for 7 hours. The samples were then placed in a detection tube inside luminometer and relative light unit (RLU) reading were recorded correlating to bacteria colony counts.

Results
To understand the difference between pine and eucalyptus filters, I calculated permeability (variable k) of my filters using Darcy#s equation for flow through a porous membrane. I had measured flow rate, could calculate area of the wood piece, had the filter length, and calculated the pressure gradient based on the height of the water in the pipe (equivalent to the length of the pipe above the wood). My permeability (k) for pine was .02 kg/m s MPa and was.33 kg/m s MPa for Eucalyptus. Most of my second and third generation filters eliminated about 40%-99.7% of the bacteria. I observed that with sufficient resistivity (determined by area and length of the wood chip, Eucalyptus (Angiosperm) can be as effective as Pine (Gymnosperm). This property of the wood chip is linked to its ability to clear bacteria.

Conclusions/Discussion
Eucalyptus had much higher flow, without application of any vacuum or suction, and once we found the right length and permeability of Eucalyptus inserted into a filter design with no leakage, we found it to be as good as pine wood in eliminating 97%-100% of bacteria and making water contaminated with bacteria safe to drink.

Summary Statement
A low cost filter using locally available tree branches can be used in a simple design to make water contaminated with bacteria safe to drink and could be used to decrease waterborne illnesses in the world.

Help Received
Dad helped in cutting of wood chips and pipes

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Advait Arumugam

Project Number
J1104

Project Title
The Study of the Impact of Anthropogenic Carbon Dioxide in the Ocean and Novel Methods to Reverse Ocean Acidification

Abstract

Objectives/Goals
My project has two objectives.
1) To study how Ocean Acidification affects the health of seashells.
2) To analyze which is the best solution to mitigate Ocean Acidification out of (i) shoal grass, (ii) limestone, (iii) crushed seashells, or (iv) a mixture of crushed shells and limestone.

Methods/Materials
In order to accomplish the first objective, I monitored seashells in a jar filled with acidic synthesized sea water. I did qualitative observations of the seashells in terms of shape, texture, and color and measured the changes in pH with a pH meter over a period of twenty five days. To accomplish the second objective, I grew shoal grass in an aquarium filled with acidic synthesized sea water. I also filled three other jars with acidic synthesized sea water. In the first jar I put the crushed seashells. In the second jar I put the limestone and in the last jar I mixed the limestone and crushed seashells together. Over the course of twenty five days I regularly measured changes in the pH. I also used a hydrometer, CFL lamp, and thermometer to maintain water quality and keep the shoal grass alive.

Results
For the study of the impact of Ocean Acidification on seashells, I observed that there was a significant deterioration in the color, texture, and shape of the seashells. Another observation I made was that at the end of the experiment the seashells flaked off and the pH of the water increased. For the second part of my experiment, I observed that the change in pH of the water in the aquarium of shoal grass was greater than the other solutions. The jars with limestone and mixture of crushed shells and limestone both had same change in the pH. Lastly, the jar with crushed shells alone had least change in pH. These observations were consistently observed both times I did the experiments.

Conclusions/Discussion
The observations from the first part of my experiment prove my hypothesis that sea shells deteriorate in acidic water. It can be concluded from the results of the second experiment that shoal grass is the best solution out of all four for mitigating Ocean Acidification. The other solutions also had significant effects on increasing the pH and therefore, we can conclude that all four of the solutions could be implemented to reduce Ocean Acidification. We can use the appropriate solution depending on cost, location, and compatibility with the nearby ecosystems for each area intended to be treated.

Summary Statement
I proved that Ocean Acidification degrades seashells and out of the four solutions proposed, shoal grass was the most efficient method to mitigate Ocean Acidification.

Help Received
My parents funded this project, helped me obtain materials, and reviewed my report.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Yusuf A. Atesoglu

Project Number

J1105

Project Title

The Effect of Plastic Bottles on Reducing Copper from Contaminated Water

Abstract

Objectives/Goals

The experiment was to determine and measure the effect of plastic bottle pieces on water containing copper. My hypothesis was that if plastic bottle pieces are used to reduce copper in the water then the copper will be decreased because of the substances, Cysteine in the plastic bottles will help to absorb copper from contaminated water. My objective was to see if plastic bottle pieces could be used as a purifier of water contaminated with copper.

Methods/Materials

The experimental set-up was made up of 3 groups of 19 Amber glass containers per group. Each container was filled with 300mL of distilled water and 1.0 ppm copper solution. Each group was mixed with different amounts of plastic bottle pieces; none for control, 1.0 grams, 2.0 grams, 3.0 grams. Allowed each measurement of plastic bottle pieces to sit in the copper contaminated water for a period of 24 hours, than again for a period of 48 hours and then one last time for a period of 72 hours. Plastic bottle pieces were filtered from the water samples with filter paper. Filtered water samples were tested for copper concentration with LaMotte Copper Test Kit(Model#3619/EC-70)

Results

The results were that 1 gram of plastic bottle pieces reduced 70.33% of the copper in 24 hours, 1 gram plastic bottle pieces reduced 80.83% in 48 hours and finally 1 gram reduced 97.83% in 72 hours. When 2 grams of plastic bottles were left in the water sampled they reduced 80.83% amount of copper in 24 hours, 88.33% in 48 hours and 98.33% in 72 hours. When 3 grams of plastic bottle pieces were left in the water samples they reduced 84.16% in 24 hours, 89.16% in 48 hours and 99.33% in 72 hours.

Conclusions/Discussion

I concluded that the more plastic pieces used and the longer the plastic stayed in the water resulted in greater cleanup of the copper from the water samples and that this filtering method can help many people in 3rd world countries and in houses and schools throughout America.

Summary Statement

My project proved that plastic bottle pieces have an incredibly positive effect on the reducing copper from contaminated water.

Help Received

Parents helped experimental set-ups and take pictures.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Danya Balagopal

Project Number

J1106

Project Title

Recycling Food Waste as Biochar to Sequestering Carbon, Improving Soil Nutrition, and Growth of Plants in Urban Areas

Abstract

Objectives/Goals

This experiment hypothesizes that biochar made of spinach, mushroom and banana (SMB) peel food waste will sequester carbon, increase soil nutrition and plant growth more than similarly pyrolyzed coffee waste biochar or orange peel waste biochar.

Methods/Materials

The objective of the experiment was to measure carbon emissions, monitor soil improvements and measure the growth of plants. Sandy soil laden with food waste simulated a landfill control. A commercial carbon test kit measured carbon dioxide emissions from the different types of food waste biochar that were introduced into sandy soil under a heat lamp. The control for each biochar type was plain sandy soil. The soil nutrition test used the Rapitest soil test kit and measured NPK content in sandy soil when the different types of biochar were added. The final test measured the growth of radish plants using a measuring tape in the biochar amended soil.

Results

The hypothesis was supported. SMB biochar reduced carbon emissions by 3.6%, coffee ground biochar reduced carbon emissions by 2%, and, orange peel biochar reduced emissions by 1% reduction as compared to their respective ambient controls. Soil nutrition was maximized (NPK content) compared to deficient levels in the control. SMB biochar amended soil had the highest plant growth (120mm), followed by orange peel (90mm) and coffee grounds (70mm).

Conclusions/Discussion

The hypothesis was supported. By pyrolyzing urban food waste into biochar, we can reduce 26% of our total global carbon footprint. My experiment proved that food waste that is disposed in landfill increases carbon emissions by 39%. My experiment also proved that SMB biochar reduced the carbon emissions by 21%, coffee ground reduced carbon emissions by 19%, and orange peel reduced carbon emissions by 16%. Additionally, my experiment proved that slow pyrolysis allowed the resultant carbon structures to retain their respective inherent N, P, and K properties associated with the original biomass. By pyrolyzing food waste, we can reduce carbon emissions in two-ways: by sequestering the carbon in the food waste, and by growing plants and trees in degraded soil.

Summary Statement

By pyrolyzing our food waste into biochar, we can sequester carbon, improve soil nutrition to green our urban environment and reduce emissions.

Help Received

None. I designed, built, and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Rebecca D. Barnett

Project Number
J1107

Project Title
Worm World: Vermiculture Using Lumbricus terrestris and Eisenia foetida and the Effect They Have on Soil Composition

Abstract

Objectives/Goals
The objective of this study is to discover how the diet of Lumbricus terrestris and Eisenia foetida affects their growth, reproduction, and the quality of the soil they process.

Methods/Materials
160 Lumbricus terrestris, 160 Eisenia foetida, eight buckets of soil, soil test kit, shredded wheat and oat cereal, leaves and grass clippings, broccoli and carrots, shredded newspaper. Weighed and divided the worms up into eight buckets with 40 worms of the same species to each bucket and then fed four separate diets to both types of worms for a total of eight weeks. Tested the soil, weighed and counted the worms after eight weeks to determine the best diet to help enrich the soil.

Results
The soil test showed increased nitrogen levels in all 8 samples. Eisenia foetida in carrots and broccoli diet increased the most in weight. Eisenia foetida in cereal diet increased the most in numbers. The soil in the cereal diet increased or maintained the nutrient levels.

Conclusions/Discussion
For soil nutrients, the cereal diet was determined to be the best food source in both test species as it maintained both the phosphorus and ph level while increasing the nitrogen and potash. This might be caused by the cereal having added vitamins and minerals which were broken down by the worms and put into the soil. The worms had the biggest weight gains with the broccoli and carrots as a food source. This might be caused because it was easy for the worms to eat since it is a vegetable and more natural.

Summary Statement
I found that worms can enrich the soil which makes vermicomposting practical for organic farming and less developed agricultural regions.

Help Received
I researched and conducted the experiment myself. My Dad helped me interpret the data for the graphs and my Mom helped construct the backboard.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ava Cannizzaro

Project Number
J1108

Project Title
Adding Structure to Water: A Novel Approach for Treating Wildfires

Abstract

Objectives/Goals
The objective of this study is to understand which super absorbent polymer worked best in adding structure to water. The idea is that a wall of water would be a better application in treating the progression of wildfires.

Methods/Materials
Five different variables were tested. The first three were different volumes of super absorbent polymer (SAP): regular (low volume SAP), fake snow (medium volume SAP) and Orbeez (high volume SAP). The last two variables were water and the removal of fuel.

The model was designed with a strip or lane of fuel (wood flakes). Two matches at the end of the strip acted as indicators for fire progression. The polymers were saturated with water and applied to the test zone in the model.

Results
After running seven trials, the Orbeez proved to work the best. They used the least amount of water and had the highest volume which led to the #water barrier# having the best structure preventing the fire from progressing. Following the Orbeez was the fake snow with the second highest volume, then the regular super absorbent polymer, then removal of fuel and in last was the water. Water alone did not control the fire.

Conclusions/Discussion
The results show that my hypothesis should be correct in that water with structure would be better than water alone in controlling wildfires. The specific approach applied here was to add structure to water to diminish both heat and oxygen from the fire triangle. The water alone did not control the fire. The water had no structure and essentially sank to the bottom of the model. This would be equivalent in a wild fire to simply pouring water on the ground and watching it absorb in the soil. The more volume and more structure of the water, the more it prevented the fire from progressing.

Summary Statement
I measured the ability to stop the progression of a wildfire (based on a model) with the application of hydrated superabsorbent polymers.

Help Received
I discussed the model with my advisor and he helped me build the model and ensure safety of running a fire model. I also discussed my approach with Captain Carlos Nieves of the Boston Fire Department.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Graziella M. Cosentino

Project Number
J1109

Project Title
Does Recycled Paper or Non-Recycled Paper Biodegrade Faster?

Abstract

Objectives/Goals
The objective of my science fair project was to determine whether recycled or non recycled paper would biodegrade faster and how moisture will affect the process.

Methods/Materials
I purchased recycled and non recycled products for each type of paper: binder paper, napkins, bath tissue, and paper towels. I then massed them in grams with an extremely fine scale. Next I buried the sheets of paper that would be dry. Then I repeated that step in soil that was kept moist, left all the papers buried for three months, and watered the pots that needed water. At the end of the three months I dug up all the papers, took photographs, and the mass of each.

Results
All materials in the wet soil, whether they were non recycled or recycled, biodegraded 100%. Both recycled and non recycled bath tissue and paper napkins biodegraded completely. The non recycled binder paper with no water biodegraded 50.39% and the recycled binder paper with no water biodegraded 50.77%. Non recycled paper towel with no water biodegraded 76.76% and the recycled paper towel with no water biodegraded 68.60%. Based to my findings, the recycled paper products did not lose more mass than the non recycled paper products.

Conclusions/Discussion
Both recycled and non-recycled paper seem to biodegrade the same and does not have a huge affect on the earth. My hypothesis that wet soil would make products biodegrade quicker, seems to be correct.

Summary Statement
I conducted an experiment to determine if recyled or non-recyled paper products affect how quickly paper biodegrades, I found that there is not a significant diference between recycled and non-recyled paper in biodegration.

Help Received
I did not receive any help. I researced biodegradation of paper and performed the experiment on my own.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Haleyann N. Currier

Project Number
J1110

Project Title
How to Remove Crude Oil from Seawater Using Heat, Paraffin Wax, and Gravitational Differences

Abstract

Objectives/Goals
The objective of this project was to determine if crude oil can be separated from seawater using a paraffin wax plug, heat, and centrifugal force.

Methods/Materials
The first step was to make simulated seawater using distilled water and Kosher salt. The seawaters specific gravity was tested with a hydrometer. Next, I simulated crude oil by using a recipe from www.quora.com, which was a mixture of gasoline, Zippo lighter fluid, diesel fuel, motor oil, and paraffin wax. I needed two crude samples so I used 0w-30 motor oil for light density and 15w-40 motor oil for a heavier density crude. Then, I prepared 4 separate test tubes of oil/seawater mixes. To create a plug for separation I added paraffin wax chips to the thoroughly mixed crude/seawater mixes and heated in boiling water. The temperatures were tested with a infrared temperature gun. All four test tubes were placed in a centrifuge and spun at 6,000 RPM for 5 minutes. Finally, all samples were removed for inspection.

Results
As the main objective of my experiment was to place a solid wax plug between the seawater and crude oil, the results were a full wax like plug containing all of the crude oil sample and paraffin wax on top and cleaned seawater on bottom. This result does support my theory of density shifting however, it does not support my theory of wax plug separation. I believe that heat was a factor. If I was to do this project again I would vary several heat levels for each sample to check for differences. I would also vary the amount of paraffin wax to the mix.

Conclusions/Discussion
Although the results varied from my expected results, I think this is a viable means of removing crude oil without re-contaminating the seawater while extracting as the crude is solidified. If I was to add anything to the project it would be testing how to de-solidify the crude wax plug to see if I can get the crude to return to its original state.

Summary Statement
Using a centrifuge, i manipulated gravitational differences to create a paraffin wax plug that effectively separated crude oil from seawater.

Help Received
I designed, built, and conducted most of the project myself, however, i did receive help, safety tips and supervision from my father Scott Currier, while mixing the chemicals for the crude oil recipe, the heating process of the samples, operation of the centrifuge he made, and understanding density theory.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Eden M. Davison

Project Number
J1111

Project Title
The Best Method of Desalination

Abstract

Objectives/Goals
Which of the three methods of desalination- forward osmosis, freezing/cryo desalination, or thermal distillation, is the most effective and efficient method of desalination? My hypothesis is that if I control the experiments for volume, type of salt water, and length of experiment time, then thermal distillation will be the most effective, but cryo desalination will be the most efficient in cost, time, and energy, but will not completely desalinate the water. I knew from my prior science fair in 2016, that thermal distillation is effective, however inefficient because of the amount of energy required, and the length of time it takes to desalinate salt water, and the amount of water lost to evaporation.

Methods/Materials
For my thermal distillation experiments, I heated the water in a thermal chamber, let it evaporate and condense on a Lexan polymer screen at the top, and let the water slide into a pipe where the water dripped into a cup and was analyzed. During my cryo desalination experiments, I ran a few experiments in the freezer, and a few using dry ice. I had all four types of salt water freezing simultaneously in plastic containers. The forward osmosis experiments used a semipermeable membrane, and on one side was a draw solution with a high concentration of ammonia carbonate. The other side contained one of the types of salt water which should have passed through the membrane to balance out the concentration on both sides, thereby desalinating the water. I then had to heat the water mixture to evaporate the ammonia carbonate and leave behind fresh water.

Results
My results showed that forward osmosis did not work, due to the lack of proper materials (i.e., semipermeable membrane). Thermal distillation removed on average 99.8% of the salt and recovered 37% of the initial water. However, when the experiments were run for at least 9 hours, recovery was 83%. Cryo desalination removed on average 61% of the salt in water, and was more effective when the ice cube was washed with tap water. The process of cryo desalination took only 1.5 hours when dry ice was used, and recovered on average 41% of the initial water.

Conclusions/Discussion
My project supported my hypothesis that thermal distillation will be the most effective method, but that cryo desalination will be the most efficient in cost, time, and energy, but will not completely desalinate the water.

Summary Statement
I compared three types of desalination- forward osmosis, cryo desalination, and thermal distillation; and showed thermal distillation is the most effective method, and cryo desalination is more efficient but not a very effective method.

Help Received
My Dad helped me build the thermal distillation chamber, and my Mom helped me analyze the data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Rachel Eizner; Lisa Leung

Project Number

J1112

Project Title

Replacing Plastics: Innovating Biodegradable, Bio-based Plastics

Abstract

Objectives/Goals

The objective was to create a biodegradable, protein-based film that could hold at least 200 grams of weight.

Methods/Materials

Protein, water, and glycerin were used to make films. Students tested strength using a modulus involving adhesive tape and 100g weights placed in middle with the dip of films being recorded.

Information for films was found from online studies, then modified. Information for modulus was also found online, then modified.

Results

The strength (dip) of the prototypes was compared. The protein film that used casein was able to hold 200 grams and was the strongest of the films, with a dip that was, on average 30% stronger (30% less dip) than the 2nd best prototype. In addition, its transparency made it the most viable alternative.

Conclusions/Discussion

Casein films were found to be the strongest and most successful film, compared to the other two protein films: pea and brown rice. Their strength was sufficient for actual usage in packaging and as a replacement for today's plastics.

Summary Statement

We created a protein-based, biodegradable polymer film that could potentially replace non-biodegradable plastics.

Help Received

We created and tested the films entirely ourselves after doing research on methods. However, our mentor Ms. Saksena reviewed our work.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Arlyn Fabian; Haley Fernandez

Project Number

J1113

Project Title

Fog Catchers

Abstract

Objectives/Goals

The objective was to find out which material, out of 3, collected the most amount of water tested by our interpretation of fog catchers.

Methods/Materials

6 Wood Planks(45 cm by 2.54 cm),3 wood planks(30 cm by 2.54 cm), Hinged gutter guard, Plastic wrap, plastic mesh, 3 plastic window box liners, 170-liter plastic box, humidifier, drill bits, staples, graduated cylinder. Tested the 3 fog catchers for 30 minutes in a 170-liter plastic box with the humidifier 12 times.

Results

For plastic mesh(material 1), we collected an average of 11.92 mL. For plastic wrap(material 2), we collected an average of 10.4167 mL. And for metal mesh(material 3), we collected an average of 9.75 mL. Maybe the reason plastic mesh accumulated the highest amount of water was because the holes were not too big like the metal ones, but they also were something that allowed the water to cling onto.

Conclusions/Discussion

During our experiment our final conclusion was that the plastic mesh collected the most water. Our hypothesis may not have been correct, but we learned that using plastic mesh collects more. The lack of water accumulated in the metal mesh may be due to the fact that the holes may have been too big. The plastic mesh had smaller holes which may be the reason it caught more water than the metal. Although the plastic wrap didn't have any holes at all, the small ones may have given the water droplets something to cling to. All in all, it makes sense that our experiment concluded with plastic mesh as the most, since that is the material that fog catchers all over the world already use. Also, it is a more cost effective option over metal.

Summary Statement

My partner and I tested three different materials to see which one would accumualte the most amount of water with plastic mesh being the material that won.

Help Received

My partner and I designed, built, and performed the experiments ourselves.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Jazmin Flores; Karissa Westbury

Project Number

J1114

Project Title

Investigating the Effects of Different Wood Ashes and Pine Ash Configurations on Water Percolation Rate through Soil

Abstract

Objectives/Goals

The object of this study is to determine if different ash configurations will have different percolation rates through soil.

Methods/Materials

Three different types of ashes, sand, 2 clear 14' cylinders, timer, water, cookie sheet, measuring cup and paper towels.

We timed water percolation through different ashes and ash configurations.

Results

Three ashes were tested, the pine had the quickest percolation rate compared to the almond having the slowest percolation rate. When different ash configurations rates were done the slowest was 3 cups of pine ash and the quickest would be 3 inches of pine ash.

Conclusions/Discussion

Repeated trials with three different ashes proved that different ash does affect percolation rate as well as the different configurations of ash.

Summary Statement

As measured by the time it took the water to percolate through ash and soil, we proved that different wood ashes affect the rate of water percolation.

Help Received

Our Science Advisor taught us about water percolation and guided us in building the model to test it.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jahari Garcia

Project Number
J1115

Project Title
Investigating the Effects of Various Organic Substance in Changing the Nutrient Levels in Soil

Abstract

Objectives/Goals
I wanted to determine the effectiveness of various organic substance in changing the nutrient levels in soil.

Methods/Materials
I used soil and nine ounce plastic containers. The organic substances I used are broccoli, potato skins, egg shells, oranges, and chicken bones. I placed the organic substances in a food processor one at a time. After being processed I added one organic substance to each plastic container with soil. I tested the nitrogen, phosphorous, potassium, and PH in the soil with a HoldAll soil test kit prior to adding the organic substances. I placed all of the plastic containers in a covered box and placed the box outside. After three weeks, I tested the nitrogen, phosphorous, potassium, and PH in each organic substance/soil mixture six times for a total of thirty tests using the HoldAll soil test kit. After recording the results, I calculated the average nutrient change for each test variable.

Results
The oranges had the biggest effect on potassium increasing it from low to high. The broccoli and oranges had the same effect on nitrogen increasing the level from very low to medium. The only organic substance that even remotely had an effect on phosphorous was oranges. Oranges and broccoli also had the biggest effect on PH. Based on this investigation oranges came in first having the most effect on soil nutrients with broccoli coming in second place. Potassium and phosphorous are essential plant nutrients and are required in large amounts for proper growth and reproduction of plants. Using organic substance to create a healthy soil environment is a clean substitute for pesticide use in agriculture. Organic crops are becoming more and more important as we face rising concerns over illnesses, diseases, and environmental impacts.

Conclusions/Discussion
My hypothesis was that the oranges would change the nutrient levels in the soil more than the other organic substances. My results supported my hypothesis because they had the biggest effect on potassium increasing it from low to high and changed the nitrogen level from very low to medium. The oranges were the only organic substance to have any effect on phosphorous. Oranges also had a significant effect on the soil PH. This project expanded my knowledge on how organic substance can be used to create sustainable and clean crop growing methods.

Summary Statement
I used broccoli, potato skins, egg shells, oranges and chicken bones to show that organic substances are an effective substitution to pesticides in changing soil nutrients.

Help Received
Mr.Carl Gong gave me feedback on the soil test kit I selected. As a result of his feedback, I found that It was important to test the potassium, phosphorous, nitrogen, and ph in the soil. My school science teachers, Brianne Fidalgo and Susan Wright gave me guidance on how to input my results/data into the

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Annika N. Garza

Project Number
J1116

Project Title
Measuring the Biodegradability of Starch Based Bioplastics

Abstract

Objectives/Goals
The objective of this experiment is to determine how the type of starch that is integrated into a starch-based bioplastic affects its ability to biodegrade, or break down into organic compounds, in a natural environment.

Methods/Materials
Four different starch-based bioplastics, a scale, and a compost pile were used to complete the trials. I measured the weight of the bioplastics at consecutive intervals of time to determine their biodegradability. I did this by allowing them to decompose over a span of three months in the compost pile.

Results
Four different starch-based bioplastics were allowed to biodegrade over three months, and the tapioca starch bioplastic lost the largest amount of weight during this period. This shows that this bioplastic has the highest biodegradability rate in comparison to the others.

Conclusions/Discussion
The tapioca starch bioplastic's performance showed to have the highest biodegradability amongst the bioplastics, and therefore, in order to determine the material to incorporate for a starch-based bioplastic with an effective biodegradability rate the tapioca starch bioplastic should be utilized. This demonstration can allow for the tapioca starch bioplastic to become a more significant alternative to petroleum-based (also known as synthetic) plastic, environmentally speaking.

Summary Statement
I discovered that using tapioca starch in starch-based bioplastics allows for the most effective biodegradability.

Help Received
None. I planned, constructed, and performed all trials, materials (with the exception of commercial materials), and experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Melina S. Ghodsi

Project Number
J1117

Project Title
Reducing Volatile Organic Compounds: Plants vs. Filter

Abstract

Objectives/Goals
In my experiement, my objective was to reduce the health risks caused by volatile organic compounds by testing to see the most effective method of reduction.

Methods/Materials
VOC detector (General Tools VOC08 Volatile Organic Compounds Data Logger), four bromeliad plants, Cutex Regular Nail Polish Remover (8 fl. oz), and filter (spt ac-2062 tower hepa/VOC Air Cleaner with Ionizer). After three hours of nail polish remover open in a room, four bromeliad plants were placed in the room. Measure with VOC detector every hour for three hours the amount of VOC in the room. Repeat procedure with filter instead of bromeliad plants.

Results
After three hours of the nail polish remover in the room by itself, the VOC detector showed "maximum" which is above 50 parts per million of volatile organic compounds. Then after three hours of having he plants in the room, the volatile organic compounds went down to 4.70 parts per million. For the filter the VOC measurement was 0.79 parts per million after three hours. The margin between the amount of VOC each method reduced is slim. Therefore, I still recommend using a bromeliad plant because the filter has many disadvantages including much more expensive, it has an irritating noice, it consumes electricity, and it is not environmental.

Conclusions/Discussion
Vadoud Niri concluded that bromeliad plants are an effective plant that reduces volatile organic compounds from the air. After doing more research on these plants, my research supported Niri's conclusion. Since science is about using previous knowledge from other scientists and expanding on it, I used Vadoud Niri's study to elaborate on reducing volatile organic compounds from the air.
Every day, people use household items such as cleaning supplies, paint, and nail polish remover. I found that volatile organic compounds are very detrimental to our health. Reducing volatile organic compounds is especially important because people who work in nail salons are exposed to volatile organic compounds every day and this can lead to long term health affects such as liver disease, asthma, and even cancer! Other costumers in nail salons can develop short term health affects such as headaches, nausea, and allergic reactions.
In this experiment, I created awareness to this problem and I reduced these harmful toxins almost completely with two effective methods of reduction.

Summary Statement
I reduced harmful volatile organic compounds with bromeliad plants and a filter but because the filter has many disadvantages, the plants are more effective.

Help Received
I used Vadoud Niri's study from the State University of New York at Oswego as background information that showed me that houseplants can reduce harmful toxins from the air. My parents contributed to the cost of all the equipment. Mrs. Stephanie Conklin was also involved with my project.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Bianca Guerra; Antonia Perez

Project Number

J1118

Project Title

Investigating the Effects of Added Materials and Temperature on Plant Decomposition

Abstract

Objectives/Goals

The objective of this study was to determine if different variables can be added to soil to increase a plant#s decomposition rate.

Methods/Materials

Decomposition Litter bags, fresh grass clippings, soil, plastic bottles, dried leaves, banana peels, incubator, refrigerator, glass beakers, digital scale (grams measurement). We constructed 60 individual plant decomposition litter bags to use with our various testing variables. Bags were left to decompose the grass clippings for seven days. We weighed the bags on day 1 of testing and after day 7. Then the masses were subtracted to determine the total decomposition loss.

Results

After testing 6 different variables with our plant decomposition litter bags (cold environment, warm environment, room temperature environment, plastic filled bag, banana peel filled bag, and a bag filled with dry leaves), we discovered the bag that had the banana peel decomposed the most on average of the plant material in the litter bag (8.2 grams). The liter bag filled with the non-biodegradable materials was least effective on average (4.43 grams).

Conclusions/Discussion

From completing this project, we have learned the benefits of using added materials and temperature to compost. Decomposition is a natural process that aids our environment; without it, the successful growth of new plants wouldn#t be possible. Decomposition is, in many ways, a foundation for the growth and rebirth in an ecosystem. Composting is a way to harness the decomposition process and use it to our advantages, while doing something good for our environment. To accelerate decomposition rates, our testing proved adding biodegradable material (i.e. banana peels) to be effective.

Summary Statement

We showed that adding biodegradable materials to plant clippings can accelerate the natural decomposition rate.

Help Received

Jewely Lickey and Robert Nelson Middle School Science Teachers

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Nithika Karthikeyan

Project Number
J1119

Project Title
The Effect of Genotypes on Wheat's Phytoremediation Capabilities As Applied to Heavy Metals in Fracked Soil

Abstract

Objectives/Goals
The objective of this experiment was to determine if genotypes (thus species) influenced wheat#s phytoextraction capabilities for metals observed at fracked sites.

Methods/Materials
A soil test was conducted using test strips to find the most suitable soil for the experiment, in this case the soil with the highest level of chromium, cadmium, mercury, and lead. This experiment used Triticum vulgare as the experimental group and Triticum dicoccum as the control group. The seeds were grown over a period of 11 weeks and were periodically watered. The height and number of stems of the plant was recorded every 3 days. At the beginning and end pictures of cells were taken using a microscope. The pictures were then compared. Levels of the heavy metals was also taken at the end of the experiment and compared to the levels seen in the begininning.

Results
Vulgare did better than dicoccum with Lead (41.67%) and Chromium (16.67%); while dicoccum did 10% better for Mercury. Cadmium measurements did not lead to logical conclusions; due to which the hypothesis is partially supported, requiring further experimentation. For higher accuracy, measure contamination levels using X-ray refractometers, measure in-take within plant tissues, and conduct the experiment on soil from fracked sites in a controlled environment.

Conclusions/Discussion
My hypothesis was partially supported because the genotype did in fact have a difference on the height, number of stems, and amount of heavy metals remediated from the soil. However, the cadmium result led my hypothesis to be partially supported.

Summary Statement
My project is about finding out whether or not the genoytpe of wheat impacts the amount of heavy metals take out, or remediated, from the soil.

Help Received
USDA, UC Davis, Bruker, Mrs. Shannon Deza, Mr. Karthikeyan Kannappan

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Amara J. Kelley

Project Number
J1120

Project Title
Is Growing Food Wasting Water?

Abstract

Objectives/Goals
My objective is to use my previous knowledge of hydrophobic & hydrophilic properties to simulate a new farming technology called Film Farming that is supposed to maximize water efficiency. I will compare the water usage to traditional methods to determine how much, if any, increase in watering efficiency is gained.

Methods/Materials
Materials: 12 similarly sized lettuce starts, 4 plastic propagation trays and plastic covers, hydrophilic polymer granules, peat based soil medium, measuring cup for water, digital thermometer/hygrometer, liquid plant nutrient, enclosed shelf with lighting.
Method: Separated the 12 plants into 4 trays, with each tray using a different farming method. Tracked water usage and growth over the course of 4 weeks.

Results
Even though the tray with only soil and water had the 2nd highest growth, it used the most water - this was my control tray. The method that showed the most water efficiency plus growth was the simulated film farming with a plastic cover. It had the highest growth AND used 33% less water than the control tray. The other two trays farming methods both saved more water overall than the tray with only soil and water, but their growth was not as dramatic.

Conclusions/Discussion
Crop covering and moderated drip irrigation are currently methods used by farmers to save more water and make food production as cost efficient as possible. It is expensive for them to invest in cutting edge irrigation technology like Film Farming. The results of my experiment confirmed my hypothesis that I could use a combination of hydrophobic and hydrophilic materials to create a simulated version of Film Farming that would save more water than strictly traditional farming methods and might be more cost effective.

Summary Statement
I showed that it is possible for farmers to conserve additional water by utilizing non-traditional materials and methods.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Andrew Kuang

Project Number
J1121

Project Title
Take Lead out of Flint Water: Cilantro as a Heavy Metal Biosorbent

Abstract

Objectives/Goals
The purpose of this study is to verify that cilantro is an effective biosorbent for lead contaminated water.

Methods/Materials
For my experiment, I chose to use hydroponics systems. These modules were easy to use, they could be left running without constant supervision, and they were consistent in the cycling of nutrients around the plant roots. I used 3 systems, so I could spot any outliers. The plants I chose were basil, cilantro, and savory, and I used 3 of each plants to have some margin for error. The control was the beginning lead water content and the variables are the different plants.

Results
Cilantro root, at the fresh form, has nearly the same lead content as the water at that time (~1.92 ppm). There seems to be a near equilibrium of roots and water. The starting lead content was 4.04ppm, after the experiment, about 52.5% was absorbed by various plants. Leaves have the lowest lead content.

Conclusions/Discussion
The following conclusions were drawn from my research:
1. The plants are absorbing lead as expected; cilantro acted as an effective absorbent.
2. The lead content in the liquid samples reduced by more than 50% percent, proving that the lead is absorbed by plants.
3. Cilantro roots have the most lead concentration. Cilantro could be used as an absorbent, but the roots would need to be removed from either the holding tank or the farm with contamination.
4. After sending my conclusions to Professor Day for a second opinion, I realized that the vacuoles in the cells might have absorbed the lead before it could have traveled into the leaves. That could explain the relatively low concentrations of lead in the leaves of the trial plants.
6. The concentration of the lead was highest in the cilantro roots, nearly at equilibrium with the lead solution. It would be good to have another round of tests to find results for other roots of the plants.
7. The lead looked as if it was mainly stored inside of the cilantro root#s vacuoles. On all of the plants, very little of the lead was inside of the leaves and stem.

Summary Statement
My research showed the feasibility of using cilantro as a bioabsorbent to remove lead from contaminated water, as in Flint Water Crisis

Help Received
1) My science teacher, Ms. Lindsey McVay for suggestions on improvements to this project 2) Mr. Siddhartha Roy from Virginia Tech, for information regarding lead and the Flint Water Crisis 3) My brother Simon (UC Berkeley, 2015 Sweepstake Runner-up) , for advice and a thorough critique 4) UCSD

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Rio E. Lauer

Project Number
J1122

Project Title
Reusing Greywater to Reduce Usage and Dependence on the Carmel River

Abstract

Objectives/Goals
The objective of this project is to determine whether reusing greyewater can reduce usage of the Carmel River.

Methods/Materials
For testing, I collected dishwasher and used sink water from restaurants, washing machine water and shower water from houses, and washing machine water from hotels. I then used a pH pool and spa test strip to test the pH level in the different waters.

Results
The results were restaurant dishwasher water and household washing machine water could be reused for toilets, but restaurant sink water should not be reused for toilets. The results show that the hypothesis should be partially correct because the peninsula could use dishwasher water, shower water, and washing machine water from houses but not washing machine water from hotels. Instead the hotels could use shower water.

Conclusions/Discussion
The tests for this experiment failed to disprove the hypothesis, which was "if greywater systems could be used for toilets then the elimination of using potable water could potentially save enough water to eliminate the need for a desal plant. This is important because a desal plant is expensive and not good for the environment." It would be possible to reuse greywater for toilets and it would save enough water to reduce usage from the Carmel River. Many of the results matched the hypothesis except sink water because it had such a low pH level so it is not the best to reuse for toilets. I was also surprised that there is a device called the AQUS water reclamation system that in a year, if everyone reused the water from sinks with this device, could reduce use of the Carmel River by 12 percent. Everything else was what I thought it would be.

Summary Statement
My testing showed that using a greywater reuse system could reduce the amount of water pumped from the Carmel River by 12 Percent and possibly eliminate the need for a desalination plant.

Help Received
I received professional advice on statistics and areas of research for my project from Ed Waggoner of Carmel Area Wastewater District and Thomas Christiansen of Monterey Peninsula Water Management District.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Aria Najmabadi

Project Number
J1123

Project Title
The Effect of Different Materials that Cover Water on Its Evaporation Rates

Abstract

Objectives/Goals
The objective of this study is to help save water from evaporating by finding a material that could prevent more evaporation than shade balls, which are black foam balls that LA County is using.

Methods/Materials
2 heat lamps, 20 50mL beakers, 800mL of water (40mL per cup), 40mL vegetable oil (8mL for 5 cup), white styrofoam balls 1cm in diameter, black paint, paintbrush. Recorded water evaporation from 4 different covers (control=no cover) with 5 trials for each daily 5 days.

Results
After 5 days of testing, vegetable oil proved the best cover for reducing evaporation. Black shade balls worked second best, white shade balls third, and the control cup with no cover worked worst.

Conclusions/Discussion
Vegetable oil worked best because it covered the water and didn't let the water escape into the atmosphere. Still, vegetable oil can't be used in reservoirs yet. I learned vegetable oil can be decomposed by organisms and release toxins. I would use more accurate measurements for water evaporation and test more liquids less dense than water (liquids more easily separated/nontoxic).

Summary Statement
I tested different covers to reduce evaporation and found liquids could work better.

Help Received
None. I did the project myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kavya M. Pandrangi

Project Number
J1124

Project Title
Measuring the Effectiveness of Indoor Plants in Reducing Indoor Air Pollution

Abstract

Objectives/Goals
The objective of this study is to measure the carbon dioxide absorption capabilities of different indoor plants and their effectiveness in reducing indoor air pollution.

Methods/Materials
I chose 5 different species of plants, each of 2 different sizes (large and small), and measured the amount of carbon dioxide absorbed by each plant one at a time using a carbon dioxide monitor. I used a homemade terrarium made from a large clear plastic box and plastic wrap to create a controlled environment for each test run over a span of 24 hrs for each plant. I also measured the leaf surface area of these plants using graph paper so that I can account for carbon dioxide absorption in ppm (parts per million) per square centimeter. I conducted several trials (10 per each plant) and calculated the average carbon dioxide absorbed per square centimeter for each plant. I tried to maintain the amount of water, exposure to sunlight and soil condition constant across all trials for all the plants.

The plants that I used in my experiment were Snake Plant (sansevieria trifasciata), Peace Lily (spathiphyllum wallisii), English Ivy (hedera helix), Gold Capella (schefflera arboricola) and Aloe Vera (aloe barbadensis miller).

Results
I found that the large English Ivy absorbed the most carbon dioxide on average over 10 trials at 310 ppm, but it was the small Snake Plant that absorbed the most carbon dioxide in parts per million per square centimeter area of the leaves, at 0.201 ppm/sq.cm.

Conclusions/Discussion
Given the large leaf surface area of the large Peace Lily, I expected that it would absorb the most carbon dioxide, but it turned out that the small Snake Plant was the overall winner. During my research, I learned that it is because Snake Plant is one of the few plants which can absorb carbon dioxide and release oxygen not only during the day, but also at night through a process called Crassulacean Acid Metabolism (CAM) photosynthesis. This was an adaptation acquired due to arid conditions in its natural habitat. Also, I learned that the reason the large English Ivy absorbed the highest average amount of carbon dioxide in ppm is because it is a very invasive plant which grows at a rapid pace and has higher stomatal density than any other plant.

Summary Statement
I showed that large variations exist in carbon dioxide absorption capabilities of common indoor plants making some plants more effective than others for reducing indoor air pollution.

Help Received
I have done the research needed, designed and performed the experiment myself at home and my science teacher reviewed my results and provided his feedback.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mona L. Patterson

Project Number
J1125

Project Title
How Can Phytoremediation Be Used to Reduce Lead Levels in Soil?

Abstract

Objectives/Goals
The objective of this experiment is to determine if phytoremediation can reduce lead levels in soil.

Methods/Materials
My materials include soil samples, brassica plants, test tubes, gloves, and soil test kits. I measured the lead levels in a 3x5 soil plot, planted brassica plants, and retested soil at 8 and 18 week intervals.

Results
Data from the first trail indicates lead levels dropped from 4 to 10 points in each of the sampled holes. Data from the second trail also shows additional lead level reduction ranging from 5 to 24 points.

Conclusions/Discussion
My results demonstrate that Phytoremediation can be an effective method for reducing lead levels in soil. It is clear that lead level reduction increases in relation to time. Therefore, more time is required in order to make significant decreases in lead levels.

Summary Statement
My experiment shows that phytoremediation can reduce lead levels in soil.

Help Received
I designed, planted, collected, and tested the soil samples for lead ranges. The samples were sent to a lab for exact lead measurements.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Sara Jean Rearick

Project Number
J1126

Project Title
Global Air Scrubber (GAS)

Abstract

Objectives/Goals
I wanted to create an inexpensive air filtration system that cleaned particles from smog-filled air.

Methods/Materials
Peat moss, ductwork, powdered titanium dioxide, fan, cardboard box, trash bags, household air filters, window screen, glue, duct tape, and cotton pads

I built a device that funneled dirty air from an industrial coal fueled fire through the filters I created. The filters were a titanium dioxide covered screen, peat moss covered screen, and a household air filter.

Results
After verifying the design of the Global Air Scrubber (GAS), I used high-quality white cotton pads to determine the number of physical particles in the air. When using the GAS without the filter, basically pure dirty air, I recorded an average of 27 out of 30 dirty cotton pads (90%). When the GAS device was tested with the full filter ensemble the number of cotton pads with physical particles was drastically reduced to 1.4 out of 30 cotton pads (4.7%). A clear trend is the filters are removing physical particles from the air and returning clean air to the environment. The filter ensemble does work.

Conclusions/Discussion
This project was important for two reasons. First, there is a demand for commercial air filters to help the environment. Next, it brought awareness to a problem that needs more solutions. All over the world tests are being conducted to find the best and least expensive air cleaning solution. This project was inline with this research and helped me learn that there are many different items that can be used to clean the air. The first filter I used was covered in peat moss. As I added filters of different substances to my device, the amount of solid particles decreased. Proposed next trials would include filter shape redesign as well as additional filter materials.

Summary Statement
My project is about learning how to create an inexpensive and efficient air filter.

Help Received
I had little help. I engineered the device and built it myself. The only help I had was building and maintaining the fires.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Nidhya Shivakumar

Project Number
J1127

Project Title
Halophytes: A Potential Solution for the Remediation of Soil in Saline Wastelands

Abstract

Objectives/Goals
Halophytes are plants that can tolerate and grow in high levels of salinity and are also potentially a rich source of biofuel. The purpose of this study is to see if halophytes can be used in the process of remediation of saline wastelands. Based on my research, my hypothesis is that halophytes will grow in high saline conditions and will decrease the saline levels in the surrounding area.

Methods/Materials
I used eight varieties of halophytes and three non-halophytes as controls. I prepared solutions containing 0g/L, 1g/L, 5g/L, and 10g/L of sea salt. I placed seeds in saline solution in petri dishes and recorded the number of seeds germinating at each salinity level. Next, I measured the root and shoot length in triplicate in various salinity levels. The percent inhibition of growth relative to the control was calculated. I used an electrical conductivity meter to measure the salinity levels of the solution containing the seedlings to assess any reduction in salinity with seed incubation. Finally, ten halophyte and control seeds were soaked in 10g/L saline for two days, then five seeds were transferred to 0g/L and growth in both dishes were compared.

Results
In saline conditions, most halophyte seeds showed better germination and growth when compared to the non halophyte controls. Interestingly, certain halophytes germinated better in low salt when compared to no salt or high salt solutions. Root and shoot analysis indicated that the growth of Salicornia Europaea was improved in the presence of increasing saline levels and Quinoa had moderate growth in high saline levels. Electrical conductivity levels is reduced in solutions containing halophytes, with Quinoa showing the most reduction. Non-halophytes were able to recover from transient salt stress, whereas halophytes such as Salicornia Europaea and Pourpier Maraicher had better growth in sustained salt solution.

Conclusions/Discussion
The observations that halophytes grow in saline conditions and lower salinity support my hypothesis that halophytes can be used to reduce the salinity levels in surrounding areas, which will enable saline waste lands to be used for agriculture. Additionally, companies like NASA and Boeing are exploring halophytes as a rich source of biofuel, and by cultivating them, we can improve the productivity of the saline wastelands and produce a new renewable form of energy.

Summary Statement
My studies showed that halophytes can grow in high salinity and reduce the salt levels in the surrounding area.

Help Received
My parents guided me in my research and provided feedback on my presentation.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Samantha O.K Slykas

Project Number
J1128

Project Title
Potable Seawater?

Abstract

Objectives/Goals
I wanted to learn which way was most efficient to desalinize seawater and find a usage for the remaining salt.

Methods/Materials
Materials: seawater, heater source, TDS meter, pH meter, filtration media, Iodine (chemical), buffering agents for calibration of meters. Experimental design and methods such as: filtration capture, boiling and condensation capture, solar and evaporation capture, Iodine for chemical change.

Results
Chemical TDS 9,400ppm / pH 7.23 Evaporation TDS 667 ppm / pH 7.07
Filtration TDS 933ppm / pH 6.95 Boling TDS 7ppm / pH 5.65

Conclusions/Discussion
I discovered that the boiling reclamation was the best method for achieving my goal, followed by evaporation (solar) .The boiling cost is effective and the solar evaporation was extremely slow for collection.

Summary Statement
Knowing that water is our most important resource, I wanted to find a cost effective way to provide potable water from seawater.

Help Received
My mother and grandfather helped me set up equipment and locate more research.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mauricio Sosa

Project Number
J1129

Project Title
A Novel Solution to Pollution

Abstract

Objectives/Goals
I investigated wheatear microorganisms can biological convert carbon into oxygen.My thought was lake microbes can be fed plastics and use carbon from plastics as food source and produce gas. My idea was that microbes from lakes can use carbon from CO2 and help reduce CO2 pollution. The microbes that grew under and around the plastics were then transferred into Phenol Red Dextrose Broth. The result showed a color change from red to yellow and the formation of gas. I sent my colonies to GeneWiz for DNA sequencing.The results confirmed that my samples contained Streptomyces, Microbacterium, and Acinetobacter; all which are found in lake waters. These bacteria leave us with the possibilities that they can convert carbon into oxygen. These possibilities not only offer solution to eliminate pollution, but also help decompose plastics.

Methods/Materials
I made nutrient agar medium to grow my microbes. I performed aseptic plating method in which one inch by one inch plastics are sterilized, dipped into the collect lake water, then placed on the agar plates. All plates were then incubated for two days. In addition, aseptic microbes transfer into Phenol Red Dextrose was performed. Furthermore, I sent some of my colonies to GeneWiz for DNA sequencing. I blasted the sequence to find out what microbes I have.

Results
The results from my tables and graphs show that a large number of colonies grew around and under the plastics, suggesting microbes found used carbon from the plastics as a food source. Phenol Red Dextrose test confirmed the formation of gas. DNA sequencing further confirmed that the bacteria found are lake microbes that are aerobic. This experiment also suggests that while these microbes have high possibilities of breaking down CO2 into cleaner gas, they can also help decompose plastics.

Conclusions/Discussion
My experiment showed that microbes found in lake water can be used to eliminate pollution. I noticed that the fermented tubes changed from bright red to cloudy yellow, and the inverted tube was clear. Large bubbles were formed inside the inverted tube. This means gas has been produced. Also, lake microbes might be an option for plastic waste degradation. I conclude that since Streptomyces, Microbacterium, and Acinetobacte offer novel solution for pollution.

Summary Statement
My project is about offering a novel solution for pollution through the use of microbes to eliminate the effects of pollution on the environment.

Help Received
My science teacher Ms. Sharif is my mentor for this project.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Samika Swamy

Project Number

J1130

Project Title

BioFresh Food Smarts: An Eco-friendly, Smart Solution to Reduce Wastage of Climacteric Produce

Abstract

Objectives/Goals

Food wastage is a massive problem globally, with one-third of all the food produced getting wasted. Roughly one trillion dollars worth of food ends up in landfills every year. Food wastage's carbon footprint is estimated at 3.3 billion metric tons of greenhouse gases emitted yearly. The goal of this project is to deliver an eco-friendly, smart solution for extending the life of climacteric produce and helping households manage their produce consumption

Methods/Materials

Key materials included climacteric produce, containers, potassium permanganate, zeolite, rice paper, Raspberry Pi, camera, and Software toolkit. BioFresh liner was built to absorb ethylene generated by produce using potassium permanganate infused zeolite pellets encased in rice paper covering. BioFresh was integrated with Smart Container for use in pantries and refrigerators. Container system included Raspberry-Pi and Camera for produce monitoring. AWS based hosted control system was built as the hub, to track stored produce. Python code with MQTT client/server mechanism was developed for information exchange between smart container and AWS. Email server in AWS generated reminders on aging produce with associated pictures to aid timely consumption

Results

Efficacy of BioFresh liner was tested using 5 climacteric produce items. Results were conclusive that BioFresh was able to extend shelf-life of produce by over two times. Testing of Smart Container proved the ability to track age of produce in container. Emails generated by AWS were deterministic about produce aging and healthy recipe information

Conclusions/Discussion

BioFresh liner with smart container can be used in households for storing climacteric produce. Produce will stay fresh for at least twice their regular lifespan. Produce aging alerts and healthy recipe recommendations can be received through email. This is a great tool to avoid wastage of food in consumption cycle, thereby helping reduce overall food losses globally

Summary Statement

Project delivers an eco-friendly, smart solution to reduce food wastage by extending life of climacteric produce with an integrated smart monitoring system

Help Received

My science teacher offered guidance and support through review and feedback

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Surya C. Tallavarjula

Project Number

J1131

Project Title

Development of Blocking Disc Method to Water Plants and Trees Efficiently and to Reduce Water Usage

Abstract

Objectives/Goals

The purpose of my project is to develop a simple low cost technique to reduce evaporation loss of water by blocking with a disc or hemispherical cover. Evaporation loss is expected to reduce since wet soil is not exposed to wind and sunlight.

Methods/Materials

Six pots were filled with potting soil and 80 ml of water was added to each. Plastic discs (3, 5, 7, 9 and 11 cm in diameters) were placed on the soil surface. One sample (control) was not covered. All samples were exposed to wind and sunlight. Inverted hemispherical coffee cup covers with black and Mylar tape and were embedded in to the soil. A central hole allows watering. Radish plants were grown in all samples. Daily weight loss was measured and the exact amount of water lost was added.

Results

In the case of discs, as the diameter increased percentage of evaporation decreased with liner relationship for the first 3 days of exposure to sun and wind. Above 5 cm diameter, the total evaporation loss decreased with a stronger dependence on diameter. Black and Mylar covered hemispherical covers showed 15% and 12% evaporation loss respectively compared to 38% shown by control (no cover) case. When radish plants were grown the control sample lost 71 g of water in a week, while black and reflective hemisphere cases lost 43 and 40 g respectively. Black cover case soil temperature was 4.2C higher compared to that of reflective cover.

Conclusions/Discussion

As the disc diameter increased the amount of wet soil exposed is decreased, and evaporation loss decreased. Water moves laterally due to adhesion. Diameter of this lateral movement depends on soil texture, small for sandy soils and bigger for clay, since large number of pores in fine grain clay increase adhesive forces. Above 5cm diameter, the resistance to lateral movement increases and evaporation loss falls steeply with diameter. For hemispherical cover the wet bulb is not only confined to narrow opening, but it is also lowered. Evaporation is reduced due to resistance to lateral movement of water and upward movement against gravity. Empirical expression was developed for evaporation suppression efficiency given by n =1-[1-(d^2/D^2)]^(5/4), where d is disc diameter and D is total soil diameter, and agrees with experimental data. This implies that soil properties suppress evaporation further more than the amount estimated by pure exposed fraction of area.

Summary Statement

Using a blocking hemispherical or planar cover soil evaporation can be suppressed and more than 30% water can be conserved.

Help Received

I prepared the hemispherical covers/discs and containers with potting soil, measured weight loss and temperature using thermocouple. My dad showed me how to calculate t-ratio of temperature data and helped me with fitting empirical expression to experimental evaporation suppression efficiency.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Orion S.S. Walter

Project Number
J1132

Project Title
Environmentally Happier Meal: Nature's Lovin' It!

Abstract

Objectives/Goals
With 1.2 to 1.3 billion McDonald's Happy Meals being sold worldwide, a Happy Meal produces a lot of material waste. My objective is to reduce at least one-third of the material waste from the Happy Meal in order to make it more environmentally sustainable.

Methods/Materials
I used various measuring devices to determine dimensions as well as used cutting devices, various papers, cardboard, paint, plastic, and adhesives to generate my prototypes.

Results
By re-engineering the McDonald's Happy Meal, I exceeded my objective which was to reduce one-third of its material waste, and by doing so I generated a more environmentally sustainable Happy Meal.

Conclusions/Discussion
By engineering new versions of the McDonald's Happy Meal, I have reduced over one-third of it's original material waste, and by doing so reduced its pollution, its plastic production, as well as made this product more environmentally sustainable.

Summary Statement
I successfully created several, significantly more environmentally sustainable versions of a McDonald's Happy Meal.

Help Received
I investigated, designed and then developed my prototypes on my own. My parents assisted in editing, cutting, printing, and gather supplies. I did listen to feed back from former science fair judges.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Scott Weston

Project Number
J1133

Project Title
Effects of Food Sources on Different levels of Vermicompost

Abstract

Objectives/Goals
More and more people are vermicomposting rather than just composting because vermicomposting creates more fertile soil and is a significantly faster process. The goal of my project is to find the best food wastes for to put into vermicompost bins. In my experiment, I tested four groups of food wastes and the resulting soil fertility. My vermicompost groups were fruit wastes, vegetable wastes, scraps(no meat) and mixed food group(all foods combined). Based upon my research I believed the mixed food group would produce the most fertile soil due to its diversity in food sources providing a variety of different minerals in the soil.

Methods/Materials
I first set up the bedding of the 20 test vermicomposting bins by shredding up newspaper, then mixing it with the proper materials(sand, coffee, coconut coir, water). I then evenly distributed worms and set up the food bins, continually feeding them every five days over a 50 day(7 week) period. Once the worms had made fertile castings, I tested 160 test samples for results with Rapitest Luster Leaf digital soil fertility test kits.

Results
I tested the vermicompost from the 20 different worm bins for levels of nitrogen, phosphorus and potassium. I repeated the tests twice for each bin. There was a significant difference for the levels of nitrogen in the fruit waste and mixed food groups. The mean for fruit waste was 34 ppm nitrates(sufficient), while the mixed food group had 56 ppm nitrates(sufficient). The vegetable group obtained 76 ppm nitrates(surplus) and the "scraps" food group nitrate level was 74 ppm(surplus).

Conclusions/Discussion
The vegetable waste and the scraps seemed to produce the most fertile soil, but all of the soil, including the mixed and fruit waste groups, contained a good supply of the proper nutrients. I was glad to find that all of the vermicompost test soils had desirable levels of nutrients, indicating fertile soil. For comparison, I tested ordinary native soil and found it lower in nutrients and much less fertile than the vermicompost. My project may help many people remember to add vegetables to the compost and not just fruit wastes alone in the bin, as fruit alone will significantly lower the levels of nitrogen. However, the vermicompost produced even with fruit alone will likely be fertile.

Summary Statement
The goal of my project was to see which food wastes contributed to the most fertile soil.

Help Received
My science teacher provided me with the proper guidance and helped me understand how a vermiculture functions. My parents drove me everywhere I needed to go and helped me gather the supplies I needed. They also provided the proper supervision. The Encinitas Soloana Center educated me on how to set up

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Elyse G. Wong

Project Number
J1134

Project Title
Full Steam Ahead, Part II: Solar Powered Water Purification

Abstract

Objectives/Goals
The objective of this study is to determine if raising the ambient temperature without any additional energy sources will increase the output of purified water in a solar powered distiller.

Methods/Materials
Parabolic dish, parabolic trough, acrylic cover for the trough, solar vacuum tubes, solar powered CPU cooler, thermometers, simulated seawater (35 parts/thousand.
Heated simulated seawater in a solar vacuum tube outdoors using a parabolic dish, an uncovered parabolic trough, and a covered parabolic trough. The steam generated was condensed through a solar powered CPU cooler and the distilled water was collected. Temperature was recorded every hour for three hours and the average temperature was calculated vs. the amount of water purified.

Results
An uncovered or covered parabolic trough produced more purified water than a parabolic dish, even though the surface area of the dish was four times the area of the trough. The covered trough increased the temperature around the vacuum tube about 15 degrees C above ambient temperature and 7 degrees higher than an uncovered trough, but the amount of water produced was nearly equal between the two trough designs.

Conclusions/Discussion
Raising the ambient temperature of simulated seawater in a solar vacuum tube without any additional energy sources did not increase the amount of purified water output in a solar powered distiller. It is concluded that the amount of water production was less dependent on the temperature around the solar vacuum tube but more so on distiller design and amount of available sunlight.

Summary Statement
Increasing purified water output in a solar powered distiller is more dependent on the solar collector design and amount of available sunlight than on raising the ambient temperature.

Help Received
My father and I designed the parabolic trough and performed the trials. I received help from my uncle, a retired engineer to graph the data. I visited the Glasspoint facility in McKittrick, CA and received valuable information from Mr. Lee Foster, site manager.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ellie A. Wood

Project Number
J1135

Project Title
A Cure for the Common Flood

Abstract

Objectives/Goals
Are light weight, or absorbent materials more effective to prevent flood rain water damage than traditional heavy sandbags?

Methods/Materials
Hurricane tape, Sponges, Pipe insulator for 1# pipe, Sand bag (burlap bag), Sand bag (plastic burlap), Wire, 5 gallon bucket, garden hose
Shovel, level, Water

Results
Test #1:
Plastic Sandbag: I observed that the plastic material sand bag works well, but between two sandbags there was a small amount of seepage which is approximately 4" wide.
Permeable Burlap Sandbag: I found that the burlap leaks between two sandbags approximately 3" wide and at a second location between two sandbags a small trickle of seepage occurred.
Sponge: The sponge material was a catastrophic failure. The sponge disadheres from the tape and allowed water to pass.
Insulator Tube: The insulator tube worked well and had no seepage through any part of the water barrier.

Test #2:
Plastic Sandbag: After adjusting for the second test I found only one seepage between one sandbag measuring about 1.5 inches wide.
Permeable Burlap Sandbag: At the second test I found a small seepage which was 3 inches wide that occurred between two sandbags.
Sponge: The sponge material was a catastrophic failure. The sponge disadheres from the tape and freely allowed water to run down the driveway.
Insulator Tube: In the second test, I found some seepage because of the tape. Although I used waterproof tape, the water still permeated through the tape and created five (5) 1 inch seepages.

Test #3:
Insulator Tube: To make sure that the insulator tube clearly worked, I tested it one additional time to be sure it was just the tape that did not withhold the water and it worked!

Conclusions/Discussion

Summary Statement
My project tests lightweight alternative materials to divert rainwater in comparison to the common sand bags.

Help Received
My teacher Mr. Chris Thibodeau.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Sidra Xu; Russell Yang

Project Number

J1136

Project Title

A Novel Solution to Algal Blooms by Inhibiting Photosynthesis Using Polystyrene Balls

Abstract

Objectives/Goals

Endangering aquatic species and threatening global ecosystems, algal blooms pose a serious environmental problem around the world; yet current control methods are costly, inefficient, and use toxic chemicals which further damage the ecosystem. The goal of our project was to identify an inexpensive, reusable, and environmentally-friendly method for algae control. By floating closed-cell polystyrene balls on top of algae, certain wavelengths of light are prevented from reaching the algae as they are reflected and absorbed by the balls, thereby inhibiting photosynthesis and reducing algae growth.

Methods/Materials

Freshwater algae from a local pond, culture dishes, polystyrene balls, National Institute of Health ImageJ image analysis software

Method: Five different groups each with three replicates were set up, including one control and four experimental groups with floating polystyrene balls of different colors (blue, red, mixture of blue and red, and white). The control group consisted of algae samples without covering. Algae growth was monitored every day for 10 days. The percent coverage of the algae in culture dishes was determined by images processed through ImageJ, and the average percentage increase was calculated.

Results

The results indicated that the control group had a 3098% increase in percentage coverage, showing that the amount of algae multiplied by nearly 32 times. The algae covered with white balls experienced a 218% increase in algal growth, while the blue ball cover exhibited just 253% increase. The mixture of blue and red balls had an increase of 383%, and red balls alone had an increase of 452%.

Conclusions/Discussion

Our results show that white and blue are the most effective colors in inhibiting algal growth, reducing algal growth by more than ten-fold compared to the control group. Unlike current algal prevention methods, our method does not kill the algae once it has grown but instead prevents algae from developing in the first place.

Summary Statement

We invented a novel solution to combat the harmful algal bloom problem by inhibiting photosynthesis with a floating layer of polystyrene balls.

Help Received

We did the project by ourselves at school. Our mentor, Dr. Thomas Artiss, provided us feedback on our work.